

4.5 INFRASTRUCTURE AND DRAINAGE

This section discusses proposed utility systems at Ames Research Center, each of the alternatives' potential impacts on the local and regional systems, and proposes mitigation measures to address them.¹

A. *Water*

The following section describes the NASA Ames Development Plan's (NADP) potential impacts to the water system at Ames Research Center. Mitigation measures, where needed, are at the end of this section.

1. Standards of Significance

An alternative for the NADP would have a significant impact with respect to the water system if it would:

- Create a demand for water service that exceeds existing water supply capacity to Ames Research Center.
- Place a demand on existing water distribution facilities that exceeds available conveyance capacity to Ames Research Center.
- Substantially deplete ground water supplies.
- Exceed baseline water demand projected to occur under baseline conditions defined in Chapter 2 to the extent that this exceedance would interfere with provision of water service to existing off-site land uses.

2. Impact Discussion

Tables 4.5-1 and 4.5-2 present the annual and peak water demands for the five alternatives as a whole and in individual development areas. These demands are based on the use of low-flow plumbing fixtures in all new construction, as required by the sustainable design provisions of the NASA Research Park

¹ In this section, the precision of the calculations is appropriate for this level of environmental review. However, no detailed discussions of required infrastructure improvements should occur without performing a similarly detailed analysis of expected demands and design of proposed systems.

Design Guide. The annual water savings due to the use of low-flow fixtures is presented in Table 4.5-3. Irrigation use is listed as zero where it will be provided by reclaimed water, as discussed in the Section B, below. The annual water savings due to the use of reclaimed water for irrigation is equal to the reclaimed water demand presented in Tables 4.5-5 and 4.5-6.

a. Annual Water Demand

Existing annual demand for the development areas covered by the EIS is roughly 901 mega-liters (238 million gallons). As shown in Table 4.5-1, Alternatives 2 and 4 would each increase the total annual water demand over this amount. Alternatives 1, 3 and 5 would result in a reduction in overall annual water demand as compared to current annual demands. However, Mitigated Alternative 5 would increase annual total water demand over the existing amount.

The increased demand generated under Alternatives 2 and 4 would create additional demand on the SFWD system. However, the projected increase in demand from Alternative 4, which would be highest of any of the alternatives at 146 mega-liters (39 million gallons), would represent only 0.11 percent of the total water demand on the SFWD system projected for 2030, as shown in the San Francisco Public Utilities Commission's Water Supply Master Plan (April 2000). Alternative 2 would represent an even smaller percentage. Given the small amount of additional water demand, this would not constitute a significant impact.

b. Peak Water Demand

Existing peak demand for the development areas covered by the EIS is roughly 9,729 liters per minute (2,570 gpm). As shown in Table 4.5-2, the expected peak demands associated with Alternatives 1 through 5 would be less than this amount.

NASA AMES RESEARCH CENTER
NASA AMES DEVELOPMENT PLAN
FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT
ENVIRONMENTAL CONSEQUENCES: INFRASTRUCTURE

TABLE 4.5-1 **ANNUAL POTABLE WATER DEMAND**

ANNUAL TOTAL WATER DEMAND						
Development Area	Annual Water Demand in Mega-Liters (Annual Demand in Millions of Gallons)					Mitigated 5*
	Alternatives					
	1	2	3	4	5	
NRP	267.0 (70.5)	335.9 (88.7)	416.1 (109.9)	279.1 (73.7)	291.0 (76.9)	371.7 (98.2)
NRP Irrigation	109.5 (28.9)	0	0	0	0	0
Bay View	0	142.4 (37.6)	0	300.0 (79.3)	183.9 (48.6)	266.3 (70.4)
Bay View Irrigation	0	0	0	0	0	0
East Side/Airfield	35.5 (9.4)	121.0 (32.0)	78.7 (20.8)	131.0 (34.6)	36.5 (9.6)	36.5 (9.6)
East Side/Airfield Irrigation	6.4 (1.7)	0	6.4 (1.7)	0	0	0
Moffett Field Golf Course	115.5 (30.5)	0	0	0	0	0
Ames Campus	183.2 (48.4)	183.2 (48.4)	183.2 (48.4)	183.2 (48.4)	224.7 (59.4)	224.7 (59.4)
Ames Campus Irrigation	153.6 (40.6)	153.6 (40.6)	153.6 (40.6)	153.6 (40.6)	153.6 (40.6)	153.6 (40.6)
Total	871 (230)	936 (247)	838 (221)	1,047 (277)	890 (232)	1,053 (278)

Note: For existing facilities, demand is not reduced for low flow fixtures. Irrigation demand is included only for areas that will be irrigated with potable water.

* For details see Section 5.5

TABLE 4.5-2 **PEAK POTABLE WATER DEMAND**

Development	Peak Water Demand in Liters per Minute (Peak Demand in Gallons per Minute)					
	Alternatives					Mit. 5*
	1	2	3	4	5	
NRP	2,031 (536)	2,554 (675)	3,164 (836)	2,123 (561)	2,213 (585)	2,828 (747)
NRP Irrigation	1,761 (465)	0	0	0	0	0
Bay View	0	1,083 (286)	0	2,282 (603)	1,398 (369)	2,025 (535)
Bay View Irrigation	0	0	0	0	0	0
East Side/Airfield	270 (71)	920 (243)	599 (158)	996 (263)	278 (73)	278 (73)
East Side/Airfield Irrigation	103 (27)	0	103 (27)	0	0	0
Moffett Field Golf Course	1,325 (350)	0	0	0	0	0
Ames Campus	1,394 (368)	1,394 (368)	1,394 (368)	1,394 (368)	1,709 (451)	1,709 (451)
Ames Campus Irrigation	2,471 (653)	2,471 (653)	2,471 (653)	2,471 (653)	2,471 (653)	2,471 (653)
Total	9,355 (2,470)	8,422 (2,225)	7,731 (2,042)	9,266 (2,448)	8,069 (2,131)	9,311 (2,459)

Note: For existing facilities, demand is not reduced for low flow fixtures. Irrigation demand is included for areas that will be irrigated with potable water.

* For details see Section 5.5

TABLE 4.5-3 **ANNUAL POTABLE WATER SAVINGS**

Annual Savings in Mega-Liters (Annual Savings in Millions of Gallons)						
Development	Alternatives					Mit. 5*
	1	2	3	4	5	
NRP	44.8 (11.8)	187.3 (49.4)	240.6 (63.6)	155.4 (41.0)	175.3 (46.3)	209.7 (55.4)
Bay View	0	82.3 (21.7)	0	172.1 (45.5)	84.0 (22.2)	120.8 (31.9)
East Side/Airfield	0	71.4 (18.9)	43.2 (11.4)	78.0 (20.6)	0.7 (0.2)	0.7 (0.2)
Ames Campus	0	0	0	0	27.7 (7.3)	27.7 (7.3)
Total	45 (12)	341 (90)	284 (75)	406 (107)	288 (76)	359 (95)

Note: This table presents annual water savings due to the use of low flow fixtures. The annual water savings due to the use of reclaimed water for irrigation is equal to the reclaimed water demand presented in Tables 4.5-5 and 4.5-6.

* For details see Section 5.5

c. Off-Site Supply Lines

The Hetch Hetchy aquaduct and the three main service lines that supply water to Ames Research Center have adequate capacity to supply water for all development foreseen under all of the alternatives.

SFWD would continue to supply domestic water to Ames Research Center. As an alternative, the Bay View area could be served by the City of Mountain View. This would alter the point of connection for Bay View but would not change the regional impacts because Mountain View has stated that any water provided to NASA would come from Hetch Hetchy.

d. On-Site Water Delivery

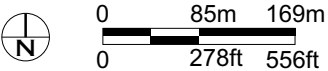
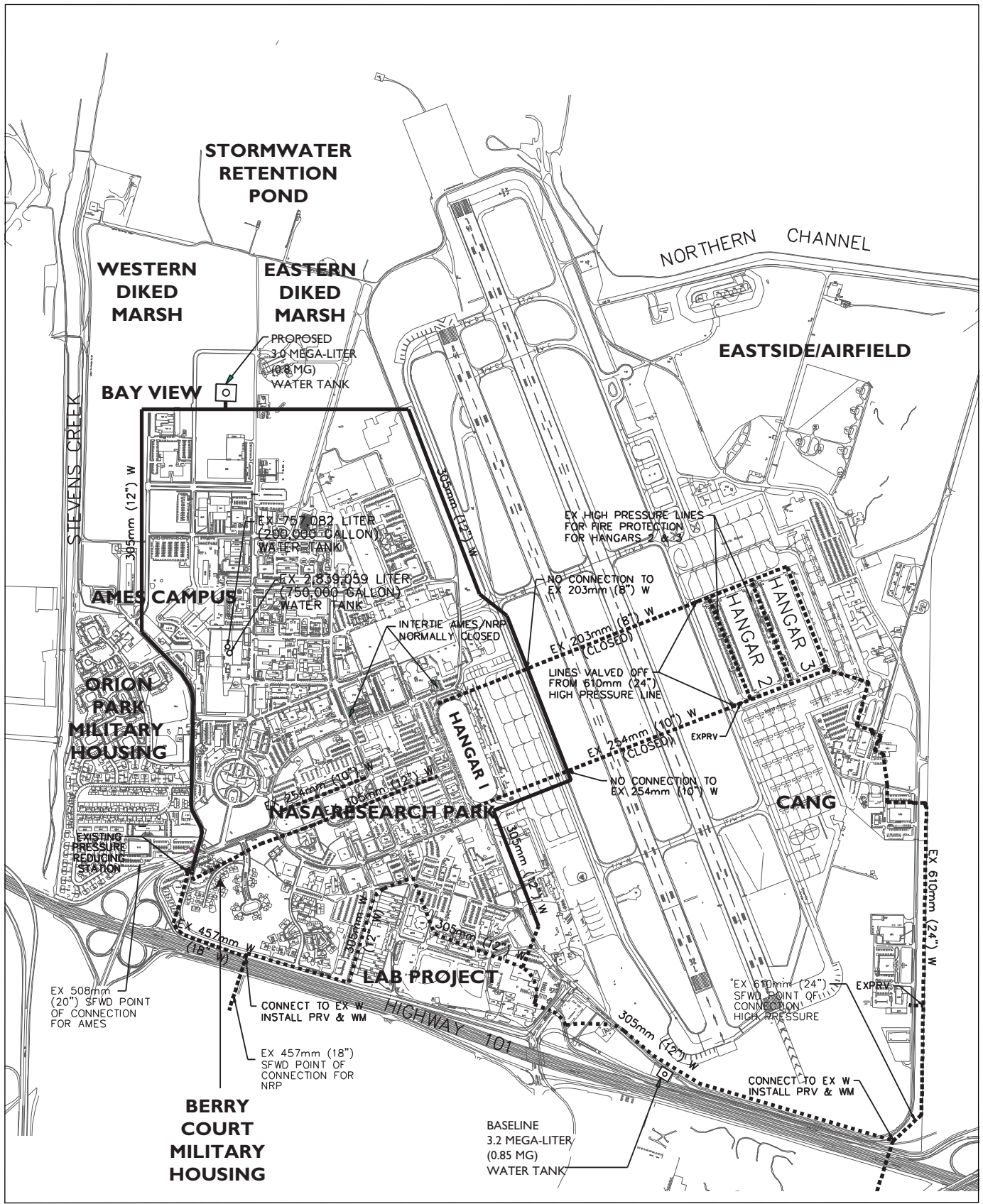
The primary factor in determining peak water demand is the flow requirement for fire protection. Under normal operating conditions, SFWD will be able to meet the demand for fire flow. In the event of an interruption of service (such as a break in the Hetch Hetchy line), emergency water supply is required to provide fire flow for the duration of the fire plus operational storage. Fire demand for all alternatives in all planning areas is 11,000 liters per minute (3,000 gpm) for 4 hours.

These conclusions assume that all new and renovated buildings would be equipped with a fire sprinkler system. Because the installation of fire sprinkler systems in buildings is so effective in assisting with fire suppression, the Uniform Fire Code allows a significant reduction in the required flow rate for development with sprinkler systems. In addition, fire sprinkler systems increase the level of protection to life and property. For these reasons, all new development under the NADP would include fire sprinkler systems.

Storage tanks for emergency water supply will be installed to provide fire flow for the duration of the fire plus operational storage in NRP and Bay View. The storage tank in Bay View will also provide for three days of average residential domestic use. A pump distribution system would be installed with each tank.

Table 4.5-4 presents the storage volume to be installed. The proposed locations of the water storage tanks are presented diagrammatically in Figure 4.5-1.

The four development areas would have independent water systems. Existing valves between the Ames Campus and Shenandoah Plaza normally remain closed because of differences in water pressure, as described in Section 3.5, and would continue to remain closed because the systems will be independent. These valves could be opened in the event of a fire in the Ames Campus area during an interruption of service. The water used to fight the fire would deplete the storage for the NRP area. A mechanism would be put in place to replenish the storage in the NRP in order to restore the level of protection for



Source: BKF

Baseline Water Mains
Proposed Water Mains —————
Water Tank ○

FIGURE 4.5-1

PROPOSED CONDITIONS WATER SYSTEM

NASA AMES RESEARCH CENTER
 NASA AMES DEVELOPMENT PLAN FINAL EIS

TABLE 4.5-4 **WATER STORAGE VOLUMES**

Development Area	Volume of Storage Liters	Volume of Storage Gallons
NRP*	3,200,000	850,000
Bay View	3,000,000	800,000

* This storage is included in the baseline condition.

which the system is designed. For example, water could be trucked in and pumped into the storage tank to be available in case of another fire.

e. Cumulative Impacts

As noted in Chapter 2, significant additional cumulative projects are planned in the Mountain View/Sunnyvale area. Although the NADP alternatives would generate little or no additional water demand, these cumulative projects would generate an increase in annual water demand of approximately 5,000 mega-liters (1,300 million gallons), which would represent an increase of 3 percent of the current annual usage in the SFWD. This would constitute a significant impact from cumulative projects, although it is not associated with the project.

3. Impacts and Mitigation Measures

Since no impacts to the water system have been identified, no mitigation measures are necessary.

B. Reclaimed Water

The following section describes the NADP's potential impacts to the reclaimed water system at Ames Research Center.

1. Standards of Significance

An alternative for the NADP would have a significant impact with respect to reclaimed water if it would:

- Create a demand for reclaimed water service that exceeds existing supply capacity.
- Place a demand on existing reclaimed water distribution facilities that exceeds available conveyance capacity.
- Interfere with provision of reclaimed water service to existing land uses.
- Interfere with provision of reclaimed water service for future, planned development.

2. Impact Discussion

a. Regional Capacity

The primary use for reclaimed water under the NADP would be irrigation. The City of Sunnyvale has indicated that there is adequate reclaimed water available from its system to serve all of Ames Research Center's irrigation demands. The City of Mountain View anticipates that its future system will also provide an abundant supply of irrigation water. The availability of reclaimed water thus would not be an issue.

In addition to sources from Sunnyvale and Mountain View, reclaimed water from the remediation of the Regional Plume is available as well, with water from the Navy available for irrigation and water from the MEW companies available for use in cooling towers and boilers.

b. Off-Site Reclaimed Water Supply Lines

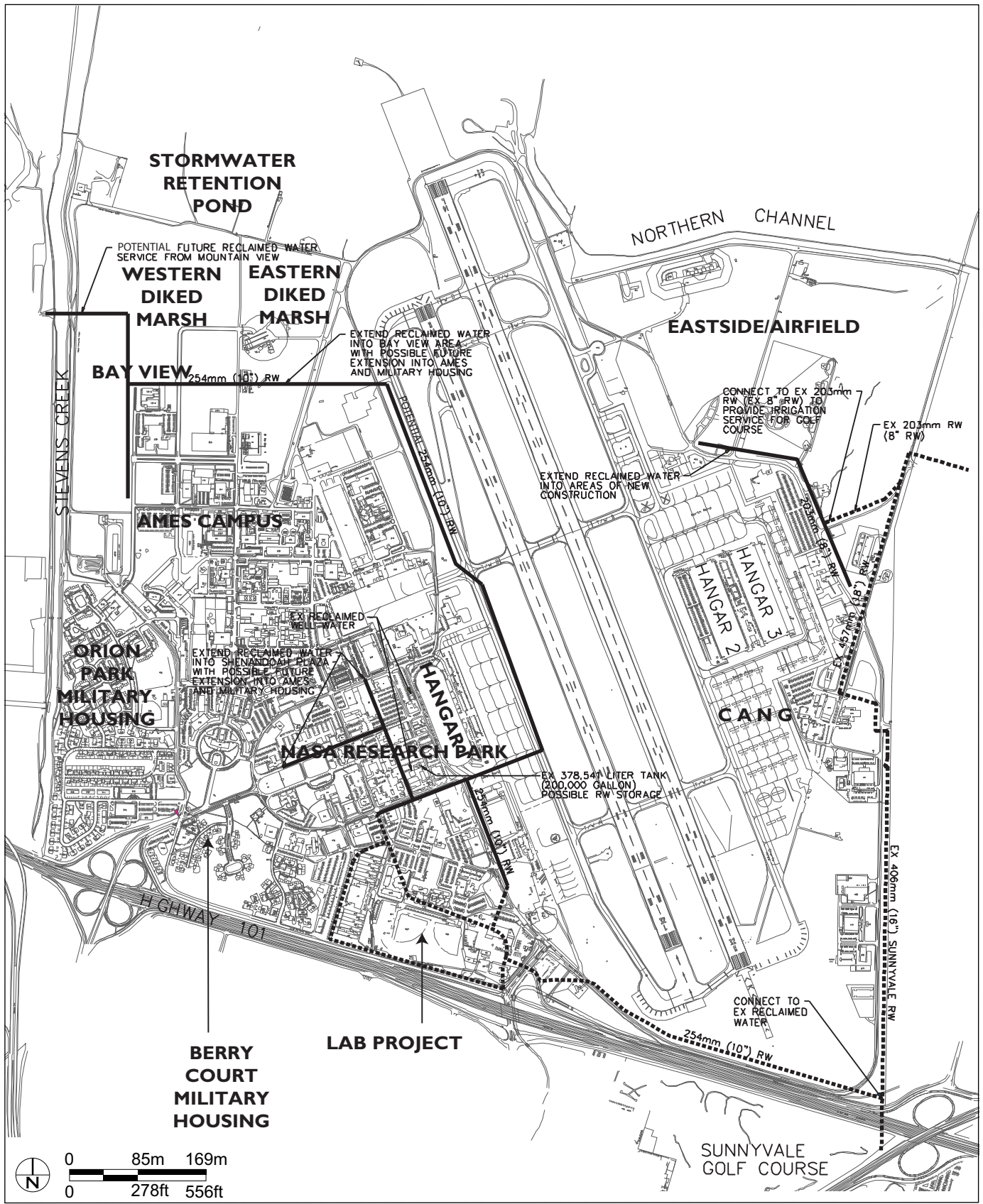
At present, a main line supplying reclaimed water from the City of Sunnyvale enters the site at the Lockheed Gate, just north of First Avenue. The line runs south along East Patrol Road and Macon Road and leaves Ames Research Center at the southeast corner of the site, near the intersection of Highways 101 and 237.

c. On-Site Reclaimed Water Delivery

The existing and proposed reclaimed water lines are shown in Figure 4.5-2.

Reclaimed water from the Sunnyvale line is available for irrigation use throughout the Eastside/Airfield area. Reclaimed water would be supplied to the other three planning areas in one of two ways, depending on the phasing of the NADP and the timing of the construction of the Mountain View supply line. The Sunnyvale reclaimed water main could be extended to the west side of the airfield to supply proposed development in the NRP area and perhaps the Bay View area as well. Alternatively, reclaimed water from the City of Mountain View could be available for the proposed development in Bay View, and could be extended into the Ames Campus and NRP areas if necessary. It may turn out that the demand from the Bay View, NRP and Ames Campus areas would require supply from both directions to meet the peak demand at the areas most distant from the points where reclaimed water enters Ames Research Center.

The proposed development in the Bay View area, parts of the Eastside/Airfield area, and the portion of the NRP area south of Shenandoah Plaza would require new roadway systems. The distribution piping for the reclaimed water would be installed along with the other underground utilities as the roadway system was developed, and would be immediately available for irrigating roadway and site landscaping. Installation of the reclaimed water system in the Shenandoah Plaza Historic District, and possible extension into the Ames Campus area, would be phased with planned upgrades in utility service.



Source: BKF

Baseline Reclaimed Water Mains
Proposed Reclaimed Water Mains ———

Note: Bay View will potentially be served from Mountain View or Sunnyvale (via NRP).

FIGURE 4.5-2

**PROPOSED CONDITIONS
RECLAIMED WATER SYSTEM**

d. Reclaimed Water Use

Tables 4.5-5 and 4.5-6 present the reclaimed water demands for irrigation under the five alternatives in each development area. Under the NADP, reclaimed water would be used for irrigation at the Moffett Field Golf Course, which is not currently the case. Therefore, peak existing potable water demand would be decreased by roughly 1,325 liters per minute (350 gpm) and annual existing potable water demand would be decreased by 115.5 mega-liters (30.5 million gallons). This is a significant reduction in the demand for potable water and represents more than 10 percent of the total expected potable water demand for Ames Research Center.

The planned use of reclaimed industrial wastewater and treated groundwater for industrial uses such as cooling and boiler makeup in the Ames Campus Area would provide additional reductions in potable water use. Total annual water savings from industrial uses would be 54.5 mega-liters (14.4 million gallons). Because NASA is in the process of implementing this program, this savings has not been deducted from total potable water demands shown in Table 4.5-1.

3. Impacts and Mitigation Measures

Since no impacts to the reclaimed water system have been identified, no mitigation measures are necessary. As noted above, however, the installation of a reclaimed water system in parts of the study area would serve to avoid impacts to water supply from the project.

C. Sanitary Sewer

The following section describes the NADP's potential impacts to the sanitary sewer system at Ames Research Center. Mitigation measures, where needed, are at the end of this section.

TABLE 4.5-5 **ANNUAL RECLAIMED WATER DEMAND (FOR IRRIGATION)**

Annual RW Demand in Mega-Liters (Annual RW Demand in Millions of Gallons)						
Development	Alternatives					Mit. 5**
	1	2	3	4	5	
NRP	17.8 (4.7)	127.2 (33.6)	127.2 (33.6)	127.2 (33.6)	127.2 (33.6)	127.2 (33.6)
Bay View	0 (0)	61.0 (16.1)	0 (0)	61.0 (16.1)	61.0 (16.1)	61.0 (16.1)
East Side/Airfield (not including golf course)	0 (0)	56.7 (15.0)	0 (0)	56.7 (15.0)	6.4 (1.7)	6.4 (1.7)
Moffett Field Golf Course	0 (0)	115.5 (30.5)	115.5 (30.5)	115.5 (30.5)	115.5 (30.5)	115.5 (30.5)
Ames Campus *	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	17.8 (4.7)	360.4 (95.2)	242.7 (64.1)	360.4 (95.2)	310.1 (81.9)	310.1 (81.9)

* Ames Campus will not be retrofitted to provide reclaimed water for irrigation use.

** For details see Section 5.5

1. Standards of Significance

An alternative for the NADP would have a significant impact with respect to the sanitary sewer system if it would:

- Create a demand for wastewater treatment that exceeds existing treatment capacity.
- Place a demand on existing wastewater collection facilities that exceeds the available conveyance capacity.
- Interfere with provision of service to existing land uses.
- Utilize treatment or conveyance capacity intended for identified future projects.

TABLE 4.5-6 **PEAK RECLAIMED WATER DEMAND (FOR IRRIGATION)**

Development Area	Peak RW Demand in Liters per Minute (Peak RW Demand in Gallons per Minute)					
	Alternatives					
	1	2	3	4	5	Mit. 5**
NRP	305 (80)	2,045 (540)	2,045 (540)	2,045 (540)	2,045 (540)	2,045 (540)
Bay View	0 (0)	985 (260)	0 (0)	985 (260)	985 (260)	985 (260)
East Side/Airfield (not including golf course)	0 (0)	910 (240)	0 (0)	910 (240)	103 (27)	103 (27)
Moffet Field Golf Course	0 (0)	1,325 (350)	1,325 (350)	1,325 (350)	1,325 (350)	1,325 (350)
Ames Campus *	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	305 (80)	5,265 (1,390)	3,370 (890)	5,265 (1,390)	4,458 (1,177)	4,458 (1,177)

* Ames Campus will not be retrofitted to provide reclaimed water for irrigation use.

** For details see Section 5.5

2. Impact Discussion

As described in Section 3.5, Ames Research Center's sewage needs are currently served by Sunnyvale, Mountain View and Palo Alto. The areas served by the each of the cities would not change with the implementation of the NADP. The Sunnyvale Water Pollution Control Plant (SWPCP) would continue to serve the NRP area, the Eastside/Airfield area (including the California Air National Guard area), the southern and eastern portion of the Ames Campus area, and the Berry Court Military Housing area through the eastern sanitary sewer system. The City of Mountain View and the Palo Alto Regional Water Quality Control Plant (PARWQCP) would continue to serve the remainder of the Ames Campus area, the Orion Park housing area, and the Bay View area through the western sanitary sewer

system. Both eastern and western sanitary sewer systems, as well as existing and proposed sanitary sewer systems, are presented diagrammatically in Figure 4.5-3.

The total peak sewer flow from proposed development under the NADP has been calculated in two ways. The first estimates the maximum flow that would be expected to leave the site and enter the conveyance system owned by the cities. For practical purposes, this flow is considered to be an instantaneous maximum, and is used to determine the impact to the sewer piping system. The second method for calculating total peak sewer flow estimates the flow that is expected to leave the site during a maximum day. This flow is used to determine the impact to the treatment plant.

Each maximum flow has two components. The first is dry weather flow. This is the flow that results from domestic and industrial use. The second component is inflow and infiltration, commonly referred to as I and I or I/I. This is the flow that results from surface storm runoff entering the sewer system through manholes (inflow) and from groundwater entering the sewer system through cracks and loose joints (infiltration). In areas of high groundwater, a certain amount of infiltration occurs during dry weather. Since the peak flows are estimated during wet weather conditions, this fine point is not critical to the calculations. For clarity, the peak wet weather flow used to determine the impact to the sewer piping system is presented in liters per minute and gallons per minute, while the peak wet weather flow used to determine the impact to the treatment plant is presented in megaliters per day and millions of gallons per day.

a. Eastern Sanitary Sewer System

Table 4.5-7 presents the sanitary sewer demands under each of the alternatives for the eastern sanitary sewer system.

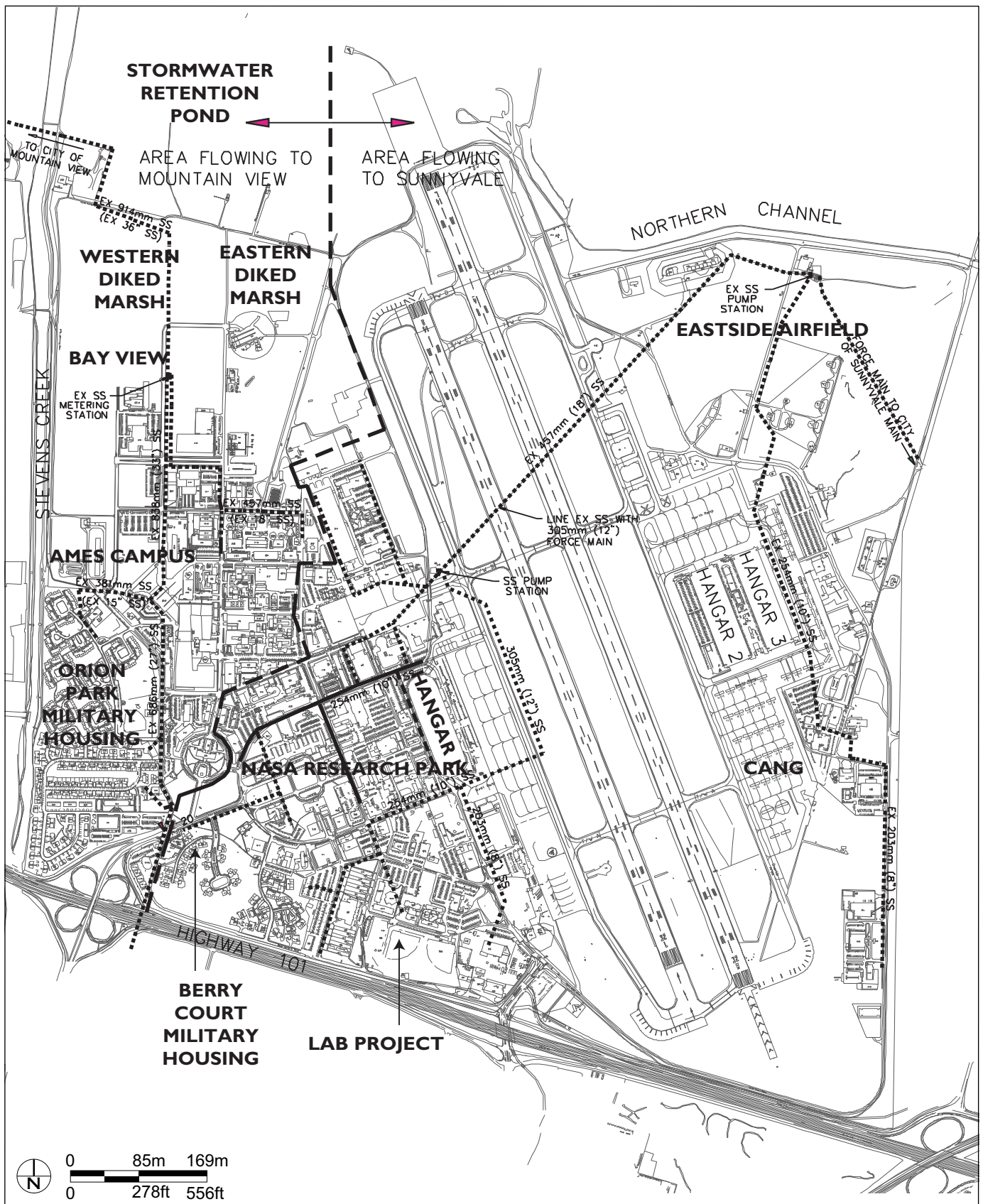
The current metered sewer flow at the existing pump station is 4,900 liters per minute (1,320 gpm) and 3.26 mega-liters per day (0.86 MGD), using the conventions in the table above. By comparison, Alternatives 1 and 5 would not create significant impacts to the existing system. The flow from Alternative 1 is almost equal to the existing flow. The flow from Alternative 5, which represents a 1.4 percent increase

over existing, is essentially equal to the existing flow given the nature of planning level calculations. The reason for the negligible increase in discharge would be the installation of new sewer lines to serve the proposed development. The new lines would reduce I/I, which would offset the increase in domestic flow from the proposed development.

The increases from Alternatives 2, 3 and 4 are greater (14 to 24 percent increase), and would be significant. Assuming a 0.5 percent pipe slope, the additional flow from these alternatives would require a parallel pipe between 152 mm (6 inches) and 203 mm (8 inches) in diameter between ARC and the treatment plant, which is the size of a standard sewer main. By comparison, Alternative 5 would require a 64 mm (2.5 inch) pipe, which is smaller than a house lateral.

Several recent developments east of Ames Research Center have impacted the conveyance system between the Center and the SWPCP, and observation indicates that portions of the system are already flowing at maximum capacity. In addition, many future development projects are planned for this area, which would produce total flows in excess of the capacity of the conveyance system. Before the discharge from Ames Research Center exceeds the historical maximum from the site of approximately 3.79 mega-liters per day (1.0 MGD), the system would have to be upgraded to accommodate the increased flows from Ames Research Center and flows from adjacent developments. Because the system consists of many interconnected lines that have been abandoned and later reopened for use, it may be more efficient to install a parallel system to convey sewer discharge directly from Ames Research Center to the SWPCP.

Treatment capacity is not an issue in the eastern sanitary sewer system because the peak daily flow from Ames Research Center with implementation of the NADP would be a small percentage of the 112 mega-liters per day (29.5 MGD) capacity of the SWPCP. Current loading on the treatment plant is 62.5 mega-liters per day (16.5 MGD) and the modest increases from the proposed project would not threaten the



Source: BKF

FIGURE 4.5-3

Baseline Sanitary Sewer Mains
Proposed Replacement Sanitary Sewer Mains ———
Limits of Municipal Sewer Service Area - - -

PROPOSED CONDITIONS SEWER SYSTEM

NASA AMES RESEARCH CENTER
 NASA AMES DEVELOPMENT PLAN FINAL EIS

TABLE 4.5-7 **EASTERN SANITARY SEWER SYSTEM DEMANDS**

	Peak Wet Weather Flow Alternatives					
	1	2	3	4	5	Mit.5*
Flow rate for determining impacts to pipe system liters per minute (gpm)	4,993 (1,319)	5,966 (1,576)	6,209 (1,640)	5,671 (1,498)	5,057 (1,336)	5,433 (1,438)
Flow rate for determining impacts to treatment plant mega-liters per day (MGD)	3.29 (0.87)	4.05 (1.07)	4.09 (1.08)	3.86 (1.02)	3.33 (0.88)	3.56 (0.94)

* For details see Section 5.5

Plant's ability to handle total peak flows from the remaining areas that it serves. Cumulative projects in the City of Sunnyvale are expected to generate 29.5 mega-liters per day (7.8 MGD), bringing the total load on the plant to 95.8 mega-liters per day (25.3 MGD), which is still less than the Plant's capacity. Discussions with the SWPCP staff indicate that the existing treatment facility has sufficient capacity to support the proposed development, and there are no plans for expansion of the facility.

As mentioned above, the installation of new sewer lines within Ames Research Center to serve the proposed development would reduce I/I, as would any repair and rehabilitation of existing sewer lines. This would reduce the total peak wet weather flow leaving the site, and could be a mitigating factor to offset the increase in domestic flow from the proposed development.

The existing sewer pump station that discharges into the Sunnyvale system has a capacity of approximately 7,600 liters per minute (2,000 gpm), which exceeds the peak flow expected from any of the alternatives. However, the pump station is nearing the end of its useful life and would need to be replaced at some point during the implementation of the NADP.

The sanitary sewer conveyance system between Ames Research Center and the SWPCP is experiencing capacity problems under existing conditions. Based on the September 2001 list of approved projects provided by the Sunnyvale Planning Department, portions of the conveyance piping will require upgrading regardless of whether or not the development proposed under the NADP proceeds. NASA is not obligated to contribute to the solution of this problem until such time as discharge from the development proposed under the NADP begins to impact the City system. At that time, NASA would negotiate an agreement with the City to contribute its fair share to the solution of the sewer capacity problem.

The discharge from Ames Research Center for the Preferred Alternative would not exceed the historical maximum of 1.0 MGD. It is assumed that the cost of the improvements to the City's sanitary sewer conveyance system would be shared by all development that discharges to the piping to be upgraded. NASA would not be obliged to commission studies of current usage, capacities and new flows of Sunnyvale's system. NASA cannot control the approval of projects outside its boundaries that would push the total flow to the SWPCP above the threshold that triggers expansion of the plant. These issues would be addressed during the CEQA process for the projects that would increase their discharge to the plant.

b. Western Sanitary Sewer System - Mountain View and Palo Alto

Table 4.5-8 presents the sanitary sewer demands for the western sanitary sewer system, which is served by the City of Mountain View and Palo Alto, for the different alternatives. The current flow is 3,300 liters per minute (872 gpm) and 2.20 mega-liters per day (0.58 MGD) using the conventions previously discussed.

Alternatives 1 and 3 would not add flow to the western sewer system. Therefore, they do not create impacts to the existing pipe system. The increases from Alternatives 2, 4 and 5 vary from 34 to 65 percent, and would be significant.

Assuming a 0.5 percent pipe slope, the additional flow from these alternatives would require a parallel pipe between 203 mm (8 inches) and 254 mm (10 inches) in diameter between ARC and the treatment plant, which is slightly larger than a standard sewer main.

TABLE 4.5-8 **WESTERN SANITARY SEWER SYSTEM DEMANDS**

Development Area	Peak Wet Weather Flow Alternatives					Mit.5*
	1	2	3	4	5	
Flow rate for determining impacts to pipe system liters per minute(gpm)	3,300 (872)	4,440 (1,173)	3,300 (872)	5,477 (1,447)	4,460 (1,178)	4,840 (1,278)
Flow rate for determining impacts to treatment plant mega-liters per day (MGD)	2.20 (0.58)	2.99 (0.79)	2.20 (0.58)	3.60 (0.95)	3.22 (0.85)	3.41 (0.90)

* For details see Section 5.5

The conveyance system between Ames Research Center and the PARWQCP already has capacity problems during wet weather. The lift station located near the Mountain View Golf Course collects discharge from a large area to the west of Ames Research Center, to the south of Highway 101, and from ARC itself. A few times each year, peak flows exceed the capacity of this lift station. When the capacity of the lift station is exceeded, the pumps shut down and the system goes into gravity bypass mode, which allows flow to back up past the Ames Research Center metering station.

In general, this situation would not change with the increased flows from the NADP. Gravity bypass mode would continue to be employed during peak flows. Although the back up would extend farther upstream and take longer to dissipate, the Mountain View system would be able to handle the increased flow. However, this operating condition does not conform to standard engineering practice and it will worsen as other development occurs. An additional 620,000 square feet of office space is planned in cumulative projects for the area currently served by the lift station. An initial study of the lift station indicates that increasing its capacity would not be an effective solution because the capacity of the pipes downstream is the limiting factor. Instead, City staff has been studying the installation of a new gravity

line between the area now served by the lift station and the PARWQCP to address the existing capacity problem and to accommodate the future expected flows from this area. This line would also serve the ARC. The existing lift station would remain in service but would serve a much smaller area.

The peak daily flow from Ames Research Center is a small percentage of Mountain View's allocation at the PARWQCP, which is 114 mega-liters per day (30 MGD) for peak wet weather flow. However, the flow for all alternatives would exceed what is specified in the 1993 agreement (which was renewed in 1999) between PARWQCP and Ames Research Center. Therefore, the agreement would need to be amended to allow for increased flows.

Cumulative projects in the City of Mountain View are expected to generate 2.3 mega-liters per day (0.6 MGD) peak wet weather flow, bringing the total load on the plant from Mountain View and ARC to 89 mega-liters per day (23.5 MGD), which is still less than Mountain View's allocation of plant capacity.

Wherever new sewer lines are installed, they would reduce I/I, as would repair and rehabilitation of existing sewer lines. This would reduce the total peak wet weather flow leaving Ames Research Center and would be a mitigating factor to offset the increase in domestic flow from the proposed development.

3. Impacts and Mitigation Measures

This section summarizes significant impacts to the sanitary sewer system, and proposes mitigation measures for each identified impact.

Impact INFRA-1: Portions of the sanitary sewer conveyance system between Ames Research Center and the SWPCP are already flowing at or near maximum capacity. Under Alternatives 2 through 5, discharge from the development proposed under the NADP would contribute to the existing capacity problems.

Applicable to: Alternatives 2 through 5, and Mitigated Alternative 5

Mitigation Measure INFRA-1: NASA would cooperate with the City of Sunnyvale in determining the cumulative impact of existing and proposed development on the sanitary sewer conveyance system between Ames Research Center and the SWPCP. NASA and its partners would contribute their fair share toward construction of conveyance pipes and supporting infrastructure which are determined to be necessary to mitigate the cumulative impact of existing and proposed development.

Impact INFRA-2: Under Alternatives 2, 4 and 5, discharge from the western sanitary sewer system would increase. The capacity of the conveyance system between Ames Research Center and the PARWQCP is not adequate for existing flows.

Applicable to: Alternatives 2, 4 and 5, and Mitigated Alternative 5

Mitigation Measure INFRA-2: New conveyance piping would be installed between the area served by the existing lift station at the Mountain View Golf Course and the PARWQCP, with sufficient capacity to accommodate the total expected flow. This would require the installation of roughly 5,486 meters (18,000 lineal feet) of pipe. Development under the NADP would contribute its fair share to the solution to this existing regional problem.

Impact INFRA-3: Under Alternatives 2, 4 and 5, discharge from Ames Research Center to the PARWQCP would increase. The plant has sufficient capacity to treat the additional flow. However, the flow for all alternatives would exceed what is specified in the 1993 agreement (which was renewed in 1999) between Ames Research Center and the Plant. NASA does not have a current flow capacity agreement with the City of Mountain View or the PARWQCP. However, NASA has a current wastewater discharge permit with PARWQCP.

Applicable to: Alternatives 2, 4 and 5, and Mitigated Alternative 5

Mitigation Measure INFRA-3: The 1993 agreement for flow capacity between the PARWQCP and Ames Research Center and between Mountain View and

Ames Research Center would be amended to address the additional flow expected from the project before commencing any development. The agreement with Mountain View would include trigger amounts and a formula for the fair share as identified in INFRA-2.

D. Storm Drainage

The following section describes the NADP's potential impacts to the storm drainage system at Ames Research Center.

1. Standards of Significance

An alternative for the NADP would have a significant impact with respect to storm drainage if it would:

- Result in storm runoff that would exceed the capacity of existing receiving bodies.
- Result in storm runoff that exceeds the available off-site conveyance capacity.
- Violate any water quality standards or otherwise substantially degrade surface or ground water quality.
- Interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table.
- Cause substantial soil erosion or loss of topsoil.
- Place housing or other improvements susceptible to flooding within a 100-year flood hazard zone as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard map.

2. Impact Discussion

As described in Section 3.5, ARC currently has two drainage systems. Proposed development under Alternatives 2 through 5 would necessitate the creation of three new drainage systems and the diversion of a portion of one of the existing systems.

Together, there would be a total of six drainage systems draining the six drainage areas shown in Figure 4.5-4.

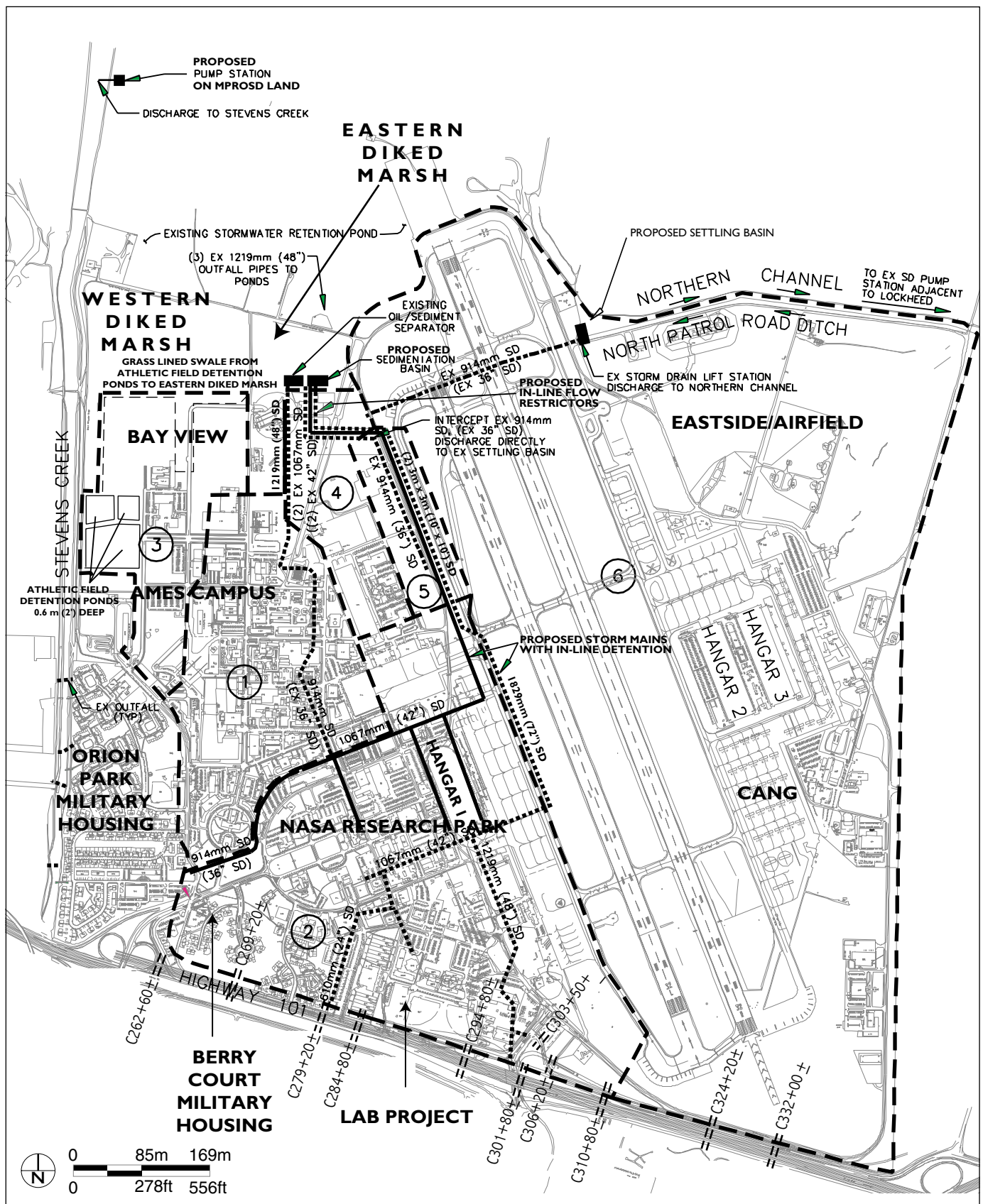
Under each of the alternatives, the amount of impervious area in the ARC would remain essentially unchanged, except in Alternatives 2, 4 and 5, which include development in the Bay View area. Under these alternatives, discharge into Stevens Creek, to the west of Ames Research Center, would increase during periods of low flow in Stevens Creek. However, discharge into Stevens Creek would be suspended during periods of high flow in Stevens Creek and diverted to the Eastern Diked Marsh via the Settlement Basin.

The storm drain design criteria employed in determining the improvements required for new drainage systems are:

- The 10-year storm would be contained in pipes without surcharging.
- The 25-year storm would be contained in pipes with surcharging.
- The 100-year storm would be contained in curbs with no flooding of buildings.
- Additional criteria would include adoption of performance standards, Best Management Practices and Standard Operating Procedures to minimize the runoff, sediment and other contaminants into the storm drain system, potentially reducing off-site flows.

a. Drainage Area 1

Drainage Area 1 is the 61-hectare (150-acre) area that can be drained by the existing storm main located within the Ames Campus with the addition of the proposed parallel discharge pipe to the north of the Ames Campus, assuming that the 10-year storm is contained in the pipes with surcharging. This does not meet the design criteria listed above for new construction. However, designing the new systems adjacent to the Ames Campus area to collect runoff from portions of Ames Campus outside of Drainage Area 1 will reduce the existing drainage problems in the Ames Campus area.



Source: BKF

Caltrans Culvert/Outlet Location	== == == ==
Baseline Storm Drain Mains
Proposed Storm Drain Mains	————
Drainage Area Boundary	— — — —
Drainage Area	
① 150 Acres	④ 50 Acres
② 320 Acres	⑤ 30 Acres
③ 100 Acres	⑥ 930 Acres

FIGURE 4.5-4

PROPOSED CONDITIONS STORM DRAIN SYSTEM

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The storm main that currently serves Drainage Area 1 runs north through the Ames Campus area and discharges into a settling basin just south of the eastern diked marsh. From there, the runoff eventually makes its way into the Storm Water Retention Pond (SWRP) north of the site. The proposed project would add a 1,219 millimeter (48-inch) pipe parallel to the existing storm mains to the north of the Ames Campus. This would reduce flooding in the northern portion of the Ames Campus while minimizing the flow to be redirected to the Bay View area (Drainage Area 3). The new pipes would discharge to the existing settling basin. The proposed project would decrease the runoff entering Ames Campus and would not impact the collection system serving this area. The existing system for discharging excess water from the SWRP into Stevens Creek utilizes mobile pumps that are brought out when the northern portion of the Ames Campus area threatens to flood. A permanent pump station with a more sophisticated operating system could be installed to provide more effective use of the SWRP to control flooding in this area. NASA would work with the Midpeninsula Regional Open Space District to determine the feasibility and location of such a facility and to obtain permission from MROSD to locate a pump on their lands. This would also benefit Drainage Areas 2, 3, 4 and 5 by making more storage volume available in the SWRP during periods of intense runoff.

The proposed permanent pump station could be integrated with the proposed storm drain system and the water level in Stevens Creek, maintaining the hydrologic conditions required for the health of the wetland and the SWRP. Immediately preceding a major storm event, the SWRP could be pumped down to the lowest level determined to be acceptable for short term conditions. As runoff from Ames Research Center began flowing into the SWRP, the pump station could continue to discharge into Stevens Creek until the water in the creek reached a cutoff level agreed upon with Santa Clara Valley Water District. The pump could then shut off until the water level in Stevens Creek began to subside. At that point, pumping could be resumed until the water in the SWRP reached the ideal level agreed upon with the Midpeninsula Regional Open Space District, where it could remain until the next major storm event. This system would relieve flooding in the northern part of Ames Campus and improve the proper operation of the proposed storm drain systems for Bay View and NASA Research Park.

If MROSD does not want the pump on their lands, NASA would locate the pump further east, in NASA's portion of the storm water retention pond. It is possible that the Navy, as part of Site 25 remediation, could construct a berm to separate the portions of the SWRP that are owned by MROSD and NASA. If so, NASA would locate the pump in the NASA portion of the SWRP.

b. Drainage Area 2

Drainage Area 2 is the 129-hectare (320-acre) area comprising the southeast corner of the Ames Campus area, the Berry Court housing area, and the NRP area. Drainage Area 2 generally drains to the north and into the same storm main that serves Drainage Area 1, exacerbating flooding problems in the Ames Campus area. Two 1,067 mm (42-inch) main lines would be installed to intercept runoff from Drainage Area 2 before it enters Drainage Area 1. One of these would be installed under baseline conditions (Alternative 1), and a second would be added under Alternatives 2, 3, 4 and 5. Both interceptors would be extended east past the West Parallel in the airfield,² then north along the western edge of the airfield into a new settling basin adjacent to the existing settling basin that serves Drainage Area 1. The proposed system will have adequate capacity to accommodate the runoff from the Caltrans right-of-way south of the project area without impeding the discharge from the existing drainage structures.

Development under the NADP would not notably increase the impervious surface in this area under any of the alternatives, and therefore would not increase the amount of discharge into the SWRP to the north. However, additional elements described below would allow the proposed improvements to the storm drain system to be implemented without increasing the peak discharge to the SWRP.

In order not to exceed the existing peak discharge to the SWRP, NASA would investigate the use of decentralized detention elements such as green roofs, grass lined swales for roof water runoff, and possibly permeable pavements to aid in achieving no net increase in peak discharge to the SWRP. In addition, structural flow

² The West Parallel is the dividing line for drainage on the western side of the airfield, as shown in Figure 3.5-4.

restrictors could be installed in the parallel mains running north along the airfield and the pipes could be sized to provide in line detention.

c. Drainage Area 3

Drainage Area 3 is the 40-hectare (100-acre) area comprising the Bay View area and the western portion of the Ames Campus area. The western portion of the Ames Campus area currently drains to the storm main that runs north through the central portion of the Ames Campus area, which does not have adequate capacity, as described in Section 3.5. The result is that excess runoff from the western portion of the Ames Campus area currently flows north into the Bay View area, which is relatively low lying, and thus able to detain a significant volume of runoff. Currently, this runoff discharges into the western diked marsh after passing through the filtration provided by the vegetation in the Bay View area. Proposed development in the Bay View area would increase the impervious surface there, producing more runoff within its boundaries.

In order not to exceed the existing peak discharge to the SWRP and control discharge into the western diked marsh, the athletic fields located in Bay View would be designed to serve as a detention pond during periods of peak runoff. The pond would discharge to a gently sloping grass lined swale in the buffer zone surrounding Bay View, which would discharge via the existing settling basin into the eastern diked marsh. This system would also provide filtration for the storm water. A certain amount of discharge from the pond would be directed into the western diked marsh in order to maintain the existing drainage conditions. NASA would investigate the use of decentralized detention elements such as green roofs, grass lined swales for roof water runoff, and possibly permeable pavements to aid in achieving no net increase in peak discharge to the SWRP.

In order to prevent flooding of the Bay View development, fill would be used to bring the finished grade up to 2 meters (7 feet) along the northern edge of the Bay View area, and slope upward to the south to conform to the existing ground at higher elevations. This would require fill to be placed over a 102,000 square meter (1,100,000 square foot) area with fill ranging in depth from 0.15 meter (0.5 feet) to

1.4 meters (4.5 feet), with an average depth of 1.2 meters (4.0 feet). The total volume of fill required would be approximately 123,000 cubic meters (160,000 cubic yards).

The new storm drain system in the Bay View area would be designed to accommodate excess runoff from the western portion of the Ames Campus area in addition to runoff from the Bay View area itself.

d. Drainage Area 4

Drainage Area 4 is the 20-hectare (50-acre) area comprising the northeast portion of the Ames Campus and an undeveloped area just to the north of it. This part of the Ames Campus area is designed to drain either to the storm main that runs north through the central portion of the Ames Campus area, or to the existing 914 mm (36-inch) storm main that runs north along the west edge of the airfield, neither of which currently has adequate capacity. To relieve these two existing mains, runoff from Drainage Area 4 would be collected in a separate pipe system and discharge into the settling basin and from there into the eastern diked marsh, or would discharge into the extension of the existing 914 mm (36-inch) storm main, which would be properly sized to accommodate the flow.

e. Drainage Area 5

Drainage Area 5 is the 12-hectare (30-acre) area comprising the northeast portion of the Ames Campus area. This part of the Ames Campus area drains to the existing 914 mm (36-inch) storm main that runs north along the west edge of the airfield. Implementation of the improvements recommended for Drainage Area 2 to the south and Drainage Area 4 to the west would allow the existing 914 mm (36-inch) storm main to properly serve the 12 hectares (30 acres) in Drainage Area 5.

f. Drainage Area 6

Drainage Area 6 is the 376-hectare (930-acre) area comprising all of the land east of the western edge of the airfield in the Eastside/Airfield area, including the California Air National Guard (CANG) area. The northern portion of the Eastside/Airfield area currently drains to the north via scattered drainage improvements and random overland flow. Runoff from Drainage Area 6 ultimately makes its way to the existing Ames Research Center storm drain lift station in the northeast area of the

airfield. The capacity of the lift station, which is almost doubled by two portable pumps, is not adequate to eliminate flooding in the northern portion of the Eastside/Airfield area during extremely wet winters. The existing condition would not be affected by any of the proposed alternatives. No changes are proposed.

A settling basin is planned to be installed just to the west of the storm drain lift station (Building 191) to treat surface water and storm water drainage discharge. The installation of this storm water appurtenance would allow for an increase in water quality prior to being pumped from Building 191 into the Northern Channel. The storm drain discharge leaving Ames Research Center via the Northern Channel would not increase due to the development proposed under the NADP.

3. Impacts and Mitigation Measures

Since there are no significant impacts to storm drainage, no mitigation measures are needed.

E. Electric Service

The following section describes the NADP's potential impacts to the electric system at Ames Research Center.

1. Standards of Significance

An alternative for the NADP would have a significant impact with respect to electrical service if it would:

- Create a demonstrable need for new or enlarged energy facilities.
- Place a demand on existing electrical distribution facilities that exceeds available conveyance capacity to Ames Research Center.
- Interfere with provision of electrical service to existing off-site land uses.

2. Impact Discussion

As noted in Section 3.5, Ames Research Center is served by two 115kV electrical substations, the Ames Research Center (ARC) Substation which is centrally located in the Ames Campus, and the Eastside/Airfield (Airfield) Substation which is northeast of Hangar 3. Existing and proposed electric systems are shown in Figure 4.5-5.

a. Electricity Supply

Recently, electrical generating capacity statewide has not been able to keep up with demand. The financial and regulatory issues that have created this situation affect the entire State of California, and not just the proposed project. The resolution of these issues will take time, and will occur through some combination of conservation and construction of new generating capacity. At this time, it is impossible to predict how much of a shortfall in electrical power will occur over the next few years, how this shortfall might affect the project, how the project might exacerbate electrical shortfalls, or how these issues will be addressed. However, it currently appears that the electricity supply situation is improving. Before the improvements proposed by the NADP are complete, it is expected that construction of new power plants will provide adequate power for the project.

The sustainable design provisions of the NASA Research Park Design Guide for development at Ames Research Center emphasize the installation of energy efficient building systems and controls, energy conservation, and the utilization of solar and other renewable energy resources. Implementation of these provisions would minimize electricity consumption and avoid any significant impact relative to electricity use.

b. Electricity Conveyance to Ames Research Center

The regional system operated by PG&E and the 115kV transmission lines that serve Ames Research Center have adequate capacity to accommodate the increased demand for electricity that would result from the proposed development.

c. On-Site Improvements

Development under the NADP would require a number of improvements to the on-site electrical system. The main features of the proposed electrical system is shown diagrammatically on Figure 4.5-5. The ARC Substation would continue to serve the Ames Campus and, because it would be the primary source of power for Switchgear C in the NRP area, it would serve the runway lighting and potentially the two Military Housing areas. This substation would provide power to the Bay View and NRP areas as well. (The Army is working with PG&E to provide power to the Military Housing from the PG&E substation at Whisman.)

3. Impacts and Mitigation Measures

There are no significant electric impacts. Therefore, no mitigation measures would be required.

F. Natural Gas Service

The following section describes the NADP's potential impacts to the natural gas system at Ames Research Center.

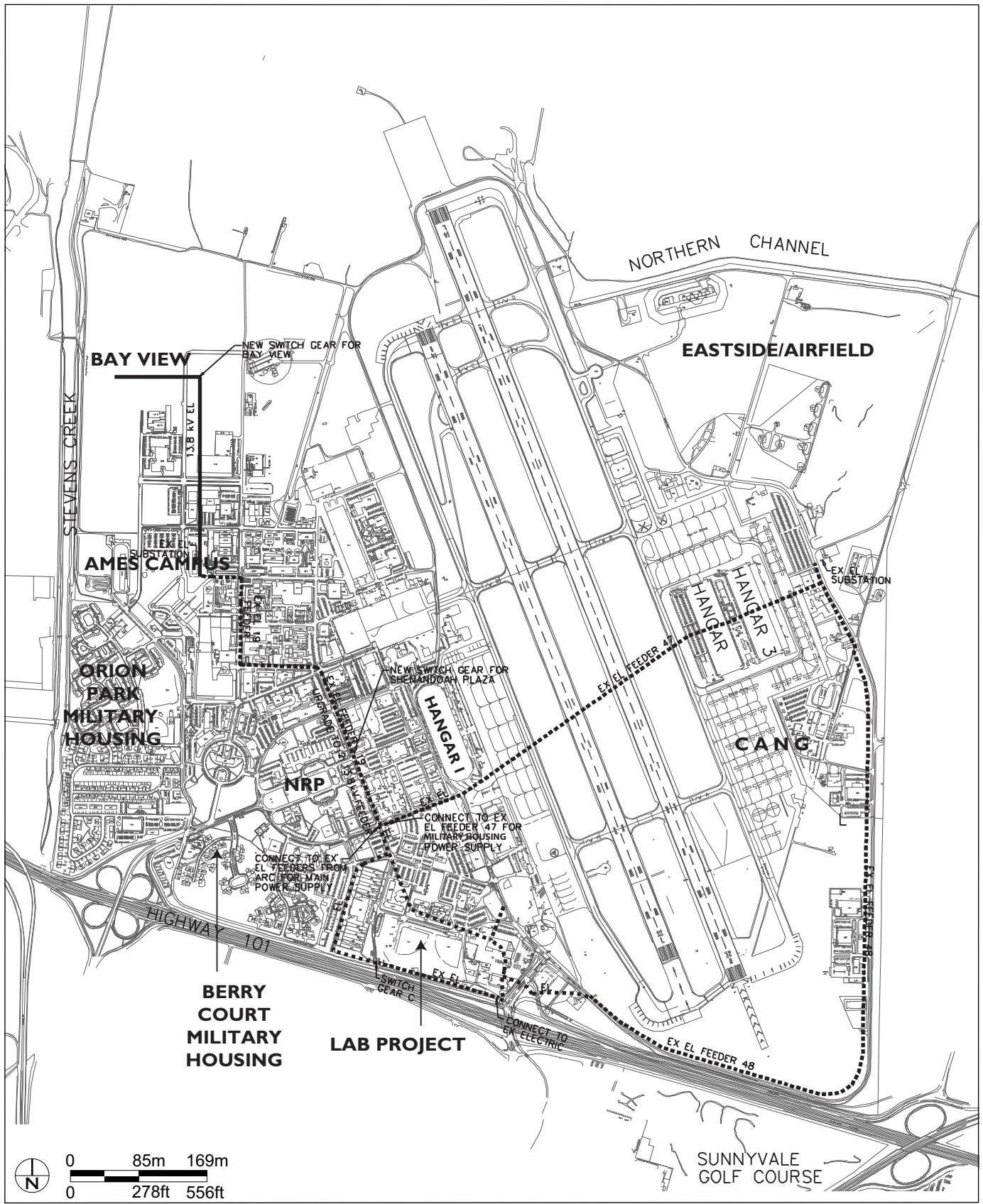
1. Standards of Significance

An alternative for the NADP would have a significant impact with respect to natural gas service if it would:

- Create a demonstrable need for new or enlarged energy facilities.
- Place a demand on existing off-site gas distribution facilities that exceeds available conveyance capacity.
- Interfere with provision of gas service to existing off-site land uses.

2. Impact Discussion

Development under the NADP would use additional natural gas. Table 4.5-9 presents the gas demands for the different alternatives and development areas.



Source: BKF

FIGURE 4.5-5

Baseline Electric Service Feeders
Proposed Electric Service Feeders —————

PROPOSED CONDITIONS ELECTRIC SYSTEM

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TABLE 4.5-9 **GAS DEMANDS**

Development	Peak Gas Demand giga-joules per year (kilo-Therms per year)					Mit.5*
	Alternatives					
	1	2	3	4	5	
NRP	121,859 (1,555)	270,306 (2,562)	342,578 (3,247)	232,641 (2,205)	268,935 (2,549)	291,619 (2,764)
Bay View	0	97,910 (928)	0	203,416 (1,928)	92,107 (873)	121,965 (1,156)
Eastside/Airfield	30,175 (286)	79,130 (750)	39,143 (371)	87,675 (831)	30,913 (293)	30,913 (293)
Ames Campus	304,912 (2,890)	304,912 (2,890)	304,912 (2,890)	304,912 (2,890)	340,257 (3,225)	340,257 (3,225)
Total	456,946 (4,331)	752,258 (7,130)	686,633 (6,508)	828,644 (7,854)	732,212 (6,940)	784,754 (7,438)

* For details see Section 5.5

Proposed development under the NADP would require the installation of new gas distribution piping within the NRP and Bay View areas. The high pressure gas mains that serve Ames Research Center have adequate capacity to accommodate the increased demand for gas that would result from the proposed development.

With regard to regional gas supply, increased demand for natural gas under the NADP would constitute a less-than-significant impact. Gas supply would be sufficient to meet the demands noted in Table 4.5-9.

Recently, delivery of natural gas in California has been limited at times but the availability of this resource is not threatened. Resolution of the financial and regulatory issues facing the greater San Francisco Bay Area and the State of

California will result in a sufficient supply of natural gas to serve any of the alternatives. There is no significant impact anticipated with regard to natural gas supply.

Furthermore, the sustainable design provisions of the NASA Research Park Design Guide for development at Ames Research Center emphasize the installation of energy efficient building systems and controls, energy conservation, and the utilization of solar and other renewable energy resources. Implementation of these provisions would mitigate any regional impact of development under the NADP.

Existing and proposed gas systems are shown in Figure 4.5-6.

3. Impacts and Mitigation Measures

There are no significant natural gas impacts. Therefore, no mitigation measures would be required.

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